

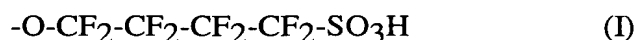
We claim:

1. A method of making a polymer electrolyte membrane comprising the steps of:
  - a) providing a suspension or solution of a blend of at least two miscible polymers, at least one of said polymers comprising a highly fluorinated backbone and at least one pendant group comprising a sulfonic acid group, wherein said blend of polymers has an equivalent weight of less than 1200, and wherein said blend of polymers has a Tg of between 101 °C and 155 °C;
  - b) casting a membrane from said suspension or solution; and
  - c) annealing said membrane at a temperature Ta equal to Tg + X where X is at least 10 °C and Ta is no more than 210 °C.
2. The method according to claim 1 wherein said blend of polymers has a Tg of between 110 °C and 140 °C.
3. The method according to claim 1 wherein X is at least 55 °C.
4. The method according to claim 1 wherein Ta is at least 135 °C.
5. The method according to claim 1 wherein said blend of polymers has an equivalent weight of less than 1050.
6. The method according to claim 1 wherein at least one of said polymers comprises pendant groups according to the formula:
$$\text{-O-CF}_2\text{-CF}_2\text{-CF}_2\text{-CF}_2\text{-SO}_3\text{H} \quad (\text{I}).$$
7. The method according to claim 1 wherein at least one of said polymers comprises pendant groups according to the formula:
$$\text{-O-CF}_2\text{-CF(CF}_3\text{)-O-CF}_2\text{-CF}_2\text{-SO}_3\text{H} \quad (\text{II}).$$
8. The method according to claim 1 wherein said membrane has a thickness of 90 microns or less.

9. A method of making a polymer electrolyte membrane comprising the steps of:
- 5 a) providing a suspension or solution of a polymer, said polymer comprising a highly fluorinated backbone and at least two different pendant groups, at least one of said pendant group comprising a sulfonic acid group, wherein said polymer has an equivalent weight of less than 1200, and wherein said polymer has a Tg of between 101 °C and 155 °C;
- 10 b) casting a membrane from said suspension or solution; and
- c) annealing said membrane at a temperature Ta equal to Tg + X where X is at least 10 °C and Ta is no more than 210 °C.
10. The method according to claim 9 wherein said polymer has a Tg of between 110 °C and 140 °C.
- 15 11. The method according to claim 9 wherein X is at least 55 °C.
12. The method according to claim 9 wherein said polymer has an equivalent weight of less than 1050.
- 20 13. The method according to claim 9 wherein at least one of said pendent groups is according to the formula:
- $$\text{-O-CF}_2\text{-CF}_2\text{-CF}_2\text{-CF}_2\text{-SO}_3\text{H} \quad (\text{I}).$$
- 25 14. The method according to claim 9 wherein at least one of said pendent groups is according to the formula:
- $$\text{-O- CF}_2\text{-CF(CF}_3\text{)-O-CF}_2\text{-CF}_2\text{-SO}_3\text{H} \quad (\text{II}).$$
15. The method according to claim 9 wherein said membrane has a thickness of 90 microns or less.

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16. A method of making a polymer electrolyte membrane comprising the steps of:
- a) providing a suspension or solution of a polymer comprising a highly fluorinated backbone and at least one pendant group comprising a sulfonic acid group, wherein said pendent groups are not according to the formula:



wherein said polymer has an equivalent weight of less than 1200, and wherein said polymer has a Tg of less than 155 °C and greater than the Tg of a Nafion® polymer of equal equivalent weight;

- b) casting a membrane from said suspension or solution; and
- 10 c) annealing said membrane at a temperature Ta equal to Tg + X where X is at least 10 °C and Ta is no more than 210 °C.

17. The method according to claim 16 wherein said polymer has a Tg of at least 101 °C.

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18. The method according to claim 16 wherein said polymer has a Tg of between 110 °C and 140 °C.

19. The method according to claim 16 wherein X is at least 55 °C.

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20. The method according to claim 16 wherein said polymer has an equivalent weight of less than 1050.

21. The method according to claim 16 wherein said membrane has a thickness of 90 microns or less.

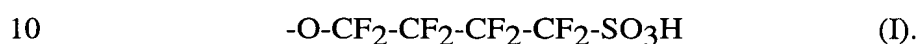
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22. A polymer electrolyte membrane comprising a blend of at least two miscible polymers, at least one of said polymers comprising a highly fluorinated backbone and at least one pendant group comprising a sulfonic acid or sulfonate group, wherein said
- 30 blend of polymers has an equivalent weight of less than 1200, and wherein said blend of polymers has a Tg of between 101 °C and 155 °C.

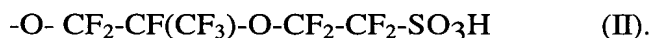
23. The polymer electrolyte membrane according to claim 22 wherein said blend of polymers has a Tg of between 110 °C and 140 °C.

5 24. The polymer electrolyte membrane according to claim 22 wherein said blend of polymers has an equivalent weight of less than 1050.

25. The polymer electrolyte membrane according to claim 22 wherein at least one of said polymers comprises pendant groups according to the formula:



26. The polymer electrolyte membrane according to claim 22 wherein at least one of said polymers comprises pendant groups according to the formula:



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27. The polymer electrolyte membrane according to claim 22 which is a cast, annealed membrane.

20 28. The polymer electrolyte membrane according to claim 22 wherein said membrane has a thickness of 90 microns or less.

29. The polymer electrolyte membrane according to claim 27 wherein said membrane has a thickness of 90 microns or less.

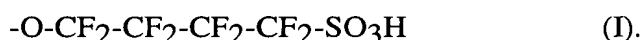
25 30. A polymer electrolyte membrane comprising a polymer, said polymer comprising a highly fluorinated backbone and at least two different pendant groups, at least one of said pendant group comprising a sulfonic acid group, wherein said polymer has an equivalent weight of less than 1200, and wherein said polymer has a Tg of between 101 °C and 155 °C.

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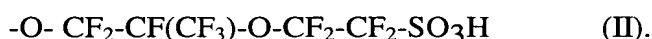
31. The polymer electrolyte membrane according to claim 30 wherein said polymer has a Tg of between 110 °C and 140 °C.

32. The polymer electrolyte membrane according to claim 30 wherein said polymer has an equivalent weight of less than 1050.

33. The polymer electrolyte membrane according to claim 30 wherein at least one of said pendent groups is according to the formula:



34. The polymer electrolyte membrane according to claim 30 wherein at least one of said pendent groups is according to the formula:

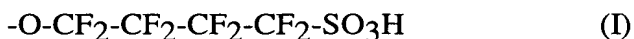


35. The polymer electrolyte membrane according to claim 30 which is a cast, annealed membrane.

36. The polymer electrolyte membrane according to claim 30 wherein said membrane has a thickness of 90 microns or less.

37. The polymer electrolyte membrane according to claim 35 wherein said membrane has a thickness of 90 microns or less.

38. A polymer electrolyte membrane comprising a polymer comprising a highly fluorinated backbone and at least one pendant group comprising a sulfonic acid group, wherein said pendent groups are not according to the formula:



wherein said polymer has an equivalent weight of less than 1200, and wherein said polymer has a Tg of less than 155 °C and greater than the Tg of a Nafion® polymer of equal equivalent weight.

39. The polymer electrolyte membrane according to claim 38 wherein said polymer has a Tg of at least 101 °C.

40. The polymer electrolyte membrane according to claim 38 wherein said polymer  
5 has a Tg of between 110 °C and 140 °C.

41. The polymer electrolyte membrane according to claim 38 wherein said polymer has an equivalent weight of less than 1050.

10 42. The polymer electrolyte membrane according to claim 38 which is a cast, annealed membrane.

43. The polymer electrolyte membrane according to claim 38 wherein said membrane has a thickness of 90 microns or less.

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44. The polymer electrolyte membrane according to claim 42 wherein said membrane has a thickness of 90 microns or less.

45. A fuel cell membrane electrode assembly comprising the polymer electrolyte  
20 membrane made by the method according to claim 1.

46. A fuel cell membrane electrode assembly comprising the polymer electrolyte membrane made by the method according to claim 9.

25 47. A fuel cell membrane electrode assembly comprising the polymer electrolyte membrane made by the method according to claim 16.

48. A fuel cell membrane electrode assembly comprising the polymer electrolyte membrane according to claim 22.

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49. A fuel cell membrane electrode assembly comprising the polymer electrolyte membrane according to claim 30.

50. A fuel cell membrane electrode assembly comprising the polymer electrolyte  
5 membrane according to claim 38.